REMARKS

Reconsideration of this application is respectfully requested.

Specification

The Action objects to the title of the invention as not being descriptive. Applicants have changed the title of the invention as suggested by the Action. Because the new title is sufficiently descriptive, Applicants respectfully ask the Office to reconsider and withdraw the objection.

Claim Rejections: 35 USC §112, paragraph 1

The Action rejects Claims 12-13, 15-40 under §112, first paragraph, as failing to comply with the written description requirement.

In view of the Examiner's suggestions, Applicants have amended Claims 12, 22 and 31, changing every occurrence of "liner oxides" to "liner oxide." Applicants have also amended Claims 13, 30 and 32, changing every occurrence of "N_2 **and** H_2" to "N_2/H_2." These amendments are all supported by the specification, thereby placing Claims 12, 13, 22, 30, 31 and 32 in compliance with §112, paragraph 1. Withdrawal of the rejection of Claims 12, 13, 22, 30, 31 and 32 is respectfully requested.

The Action rejects Claim 40. Applicants have canceled Claim 40, obviating the rejection thereof.

Claim Rejections: 35 USC §112, paragraph 2

The Action rejects Claims 12-13, 15-40 under §112, second paragraph, as being indefinite.

The Action rejects Claims 12, 22 and 31 for not clearly describing the location of the exposed surface of the liner oxide. Applicants have amended Claims 12, 22 and 31. Amended Claims 12, 22 and 31 recite, "a liner oxide formed over said substrate and on sidewalls of said gate electrode, and a gate spacer formed on a portion of said liner oxide so that said liner oxide has an exposed surface not covered by said gate spacer." Amended Claims 12, 22 and 31 clearly and distinctly describe the location of the exposed surface of the liner oxide and satisfy the statute. Reconsideration and withdrawal of the rejection of Claims 12, 22 and 31 under §112 is respectfully requested.

The Action rejects Claims 12, 22 and 31 on the assertion the clause "removing said linear oxides not covered by said gate spacers and said layer of silicon oxy-nitride" is unclear. Applicants amended the clause to: "removing a portion of said liner oxide not covered by said gate spacers and **not covered** by said layer of silicon oxy-nitride." Reconsideration and withdrawal of the rejection of Claims 12, 22 and 31 are respectfully requested.

The Action rejects various claims for lacking a proper antecedent basis. Applicants have amended the claims, obviating these rejections. Based on these amendments, Applicants respectfully request the Office reconsider and withdraw any claim rejection based on an improper antecedent basis.

Claim Rejections: 35 USC 102(e)

The Action rejects Claims 12, 13, 15, 16, 18, 20, 21, 22, 24, 26, 28-34, 36, 38-39 under §102(e) as being anticipated by Deshpande et. al (U.S. Pat. No.: 6,512,266 B1). Applicants respectfully traverse the rejection of the claims over Deshpande.

Amended Claim 12 recites:

> "...nitridizing said exposed surface of said liner oxide so as to form a layer of silicon oxy-nitride overlying said exposed surface of said liner oxide, said nitridizing step comprising an N_2/H_2 plasma exposure; "[1]

Deshpande does not disclose or suggest "nitridizing said exposed surfaces of said liner oxide so as to form a layer of silicon oxy-nitride overlying said exposed surface of said liner oxide, said nitridizing step comprising an N_2/H_2 plasma exposure," as required by amended Claim 12. Deshpande merely discloses the use of plasma-assisted chemical vapor deposition (CVD) to deposit the initial oxide layer, and does not disclose nitridizing an existing layer of liner oxide with a N_2/H_2 plasma exposure before removing a portion of the liner oxide not covered by the gate spacer and not covered by the layer of silicon oxy-nitride.

Referring to Deshpande Figure 1B, an oxide film 22 is formed over a patterned gate stack structure 14. The oxide film 22 is formed by utilizing "any conformal deposition process capable of depositing an oxide film 22, including CVD, and plasma-assisted CVD." (Deshpande, col. 5, lines 46-53). Thick spacers 24 are then formed on the oxide film 22. (Deshpande, col. 6, lines 9-16). After forming the thick spacers 24, the oxide film 22 is "subjected to an etching step wherein the oxide film 22 is recessed below the uppermost edge of the thick spacers 24 as to provide divot regions 26." (Deshpande, Figure 1C, 1D, & col. 6, lines 38-49). The etching process used to form divots 26 can take one of two forms according to Deshpande, a wet chemical etch process or a dry chemical etch process. (Deshpande, col. 6, lines 49-63). After recessing the oxide film 22 to form divot regions 26, Deshpande discloses the step of filling the divot regions 26 "with divot fill material 28, formed by a conformal deposition process such as CVD or plasma-assisted CVD." (Deshpande, Fig. 1E, col. 6, lines 63-67). The divot fill material 28 can take the form of "any dielectric material other than an oxide, such as nitride and oxynitride." (Deshpande, col 6, lines 63-67 & col. 7, lines 1-4).

[1] Support for the amendment to Claim 12 is in the initial disclosure via dependent Claims 13 and 32. No new matter or new issue of patentability is introduced by this amendment to Claim 12.

Further, Deshpande does not disclose or suggest the above feature of claim 12 under any theory of inherency either. **M.P.E.P. § 2112** recites:

> "To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is **necessarily** present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.' " *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999) (emphasis in original).

Because an N_2/H_2 plasma exposure is not necessarily present in a CVD or plasma assisted CVD method, Deshpande does not inherently disclose or suggest claim 12.

Deshpande's use of a "CVD or plasma-assisted CVD" is not an equivalent or substitute for Applicants' "nitridizing said exposed surfaces of said liner oxide...said nitridizing step comprising an N_2/H_2 plasma exposure" of amended Claim 12.

Because Deshpande fails to disclose each and every element of Applicants' Claim 12, either expressly or inherently, claim 12 is not anticipated by Deshpande under 35 U.S.C. § 102.

Further, the claimed N_2/H_2 plasma exposure would not have been obvious under § 103 either. Applicant's specification describes unexpected results of using the N_2/H_2 plasma exposure. Page 17, lines 1-8, states:

> It has been experimentally confirmed that the N_2/H_2 plasma treatment, which is preferably a low temperature treatment performed at a temperature of about 250 degrees C., reduces the etch rate of the liner oxide by about 35 to 36%. If SiO_x is used as the material of choice for the oxide liner, the N_2/H_2 plasma treatment will isotropically nitridize the SiO_x to SiO_xN_y, which results in reducing the rate at which the liner oxide will be removed during subsequent processing.

As set forth in the specification, the claimed plasma treatment reduces the etch rate of the liner oxide by about 35-36%. This dramatic reduction allows applicant's claimed method to work without creating the undesired divots and undercuts of Deshpande et al. Therefore in view of these unexpected results, claim 12 would not have been obvious to one of ordinary skill in the art at the time applicant's invention was made. Thus, claim 12 should be allowable.

Claims 13, 15, 16, and 20 are all dependent claims stemming from independent Claim 12, and are allowable for at least the same reasons as stated above. Reconsideration and withdrawal of the rejection of independent Claim 12, and each claim depending therefrom, are respectfully requested.

Amended Claim 22 recites:

> nitridizing said exposed surface of said liner oxide so as to form a layer of silicon oxy-nitride overlying said exposed surface of said liner oxide, said nitridizing step comprising an N_2/H_2 plasma exposure; removing a portion of said liner oxide not covered by said gate spacers and not covered by said layer of silicon oxy-nitride to leave a portion of said liner oxide beneath said gate spacers substantially without forming undercuts under said gate spacers

As noted above, Deshpande does not disclose or suggest "nitridizing said exposed surface of said liner oxide so as to form a layer of silicon oxy-nitride overlying said exposed surface of said liner oxide, said nitridizing step comprising an N_2/H_2 plasma exposure; ; removing a portion of said liner oxide not covered by said gate spacers and not covered by said layer of silicon oxy-nitride to leave a portion of said liner oxide beneath said gate spacers substantially without forming undercuts under said gate spacers," as required by Applicants' amended Claim 22. Deshpande teaches the use of "CVD or plasma assisted CVD" to form the initial oxide film 22, and the use of "plasma assisted CVD" to deposit divot fill material 28 **after** the oxide layer has already been recessed and the divots formed. .

The Action is mistaken in its interpretation of Deshpande. The Action alleges in two successive paragraphs (see last paragraph on page 7 and first paragraph on page 8) that Deshpande teaches "removing the oxy-nitride layer substantially without forming undercuts under the gate spacers." The Action cites Deshpande Figures 1E-1F or 2F-2G as standing for

the proposition Deshpande "removes the **oxynitride layer** substantially without forming undercuts under the gate spacers." [emphasis added] However, Claim 22 is not directed to removing the oxynitride layer without forming undercuts. Claim 22 recites, "removing a portion of the **liner oxide**." [emphasis added]. Neither of the above quoted paragraphs of the Action nor the cited Figures addresses the requirement in claim 22 for removing a portion of the **liner oxide** without forming undercuts. Claim 22 requires "removing **a portion of said liner oxide** not covered by said gate spacers and not covered by said layer of silicon oxy-nitride to leave a portion of said **liner oxide** beneath said gate spacers substantially without forming undercuts under said gate spacers." The Action confuses the "oxy nitride layer" of Deshpande with Applicants' "liner oxide" of Claim 22.

Applicants direct the Examiner to review Deshpande Figure 1D, which depicts the formation of divots 26 on the liner oxide 23 beneath gate spacer 24. Claim 22, on the other hand, recites "removing a portion of said liner oxide not covered by said gate spacers and not covered by said layer of silicon oxy-nitride **to leave a portion of said liner oxide beneath said gate spacers substantially without forming undercuts under said gate spacers**." Deshpande specifically teaches the use of an etching process "to provide divot regions 26 on the liner oxide 23 which exist between the thick spacers 24 and the semiconductor substrate 10." (Deshpande, col. 6, lines 38-48; Deshpande Fig. 1D). Deshpande teaches away from that required by Applicants' amended Claim 22.

Because Deshpande fails to disclose or suggest each and every element of Applicants' Claim 22 either expressly or inherently, and because Deshpande teaches away from that which is required by Applicants' claim 22, claim 22 is not an anticipated by Deshpande et al. under §102 and should be allowed. Claims 24, 28-30 are all dependent Claims stemming from independent Claim 22, and are allowable for at least the same reasons as claim 22. Reconsideration and withdrawal of the rejection of independent Claim 22, and each claim depending therefrom, is respectfully requested.

Amended Claim 31 recites:

> nitridizing said exposed surface of said liner oxide so as to form a layer of silicon oxy-nitride overlying an exposed surface of said gate electrode, said nitridizing step comprising a N_2/H_2 plasma exposure; removing a portion of said liner oxide not covered by said gate spacers and not covered by said layer of silicon oxy-nitride substantially without forming divots in said liner oxide beneath said gate spacer

As noted above, Deshpande does not disclose or suggest "nitridizing said exposed surface of said liner oxide so as to form a layer of silicon oxy-nitride overlying said exposed surface of said liner oxide, said nitridizing step comprising an N_2/H_2 plasma exposure; removing a portion of said liner oxide not covered by said layer of silicon oxynitride...," as required by Applicants' amended Claim 31. Deshpande teaches the use of "plasma assisted CVD" to form the initial oxide film 22, and the use of "plasma assisted CVD" to deposit divot fill material 28 **after** the oxide layer has already been recessed and the divots formed.

As noted above, the Action is mistaken in its interpretation of Deshpande. The Action alleges in two successive paragraphs (see last paragraph on page 7 and first paragraph on page 8) that Deshpande teaches "removing the oxy-nitride layer substantially without forming undercuts under the gate spacers." The Action cites Deshpande Figures 1E-1F or 2F-2G as standing for the proposition Deshpande "removes the oxynitride layer substantially without forming undercuts under the gate spacers." However, neither of these paragraphs nor cited Figures addresses the requirement in claim 31 for removing a portion of the **liner oxide** without forming divots. Claim 31 requires "removing **a portion of said liner oxide** not covered by said gate spacers and not covered by said layer of silicon oxy-nitride substantially without forming divots in said **liner oxide** beneath said gate spacer." [emphasis added] The Action confuses the "oxy nitride layer" of Deshpande with Applicants' "liner oxide" of Claim 31.

Applicants instead direct the Examiner to review Deshpande Figure 1D, which depicts the formation of divots 26 on the liner oxide 23 beneath gate spacer 24. Claim 31, on the other hand, recites "removing a portion of said liner oxide not covered by said gate spacers and not covered by said layer of silicon oxy-nitride substantially **without forming divots in said liner**

oxide beneath said gate spacer.." Deshpande specifically teaches the use of an etching process "to provide divot regions 26 on the liner oxide 23 which exist between the thick spacers 24 and the semiconductor substrate 10." (Deshpande, col. 6, lines 38-48; Deshpande Fig. 1D). Deshpande teaches away from that required by Applicants' amended Claim 31.

Because Deshpande fails to disclose or suggest each and every element of Claim 31, either expressly or inherently, and because Deshpande teaches away from the requirements of Applicants' amended Claim 31, claim 31 is not anticipated by Deshpande under §102. Claims 32, 33, 34, 38-39 are all dependent on Claim 31, and are allowable for at least the same reasons as stated above. Reconsideration and withdrawal of the rejection of independent Claim 31, and each claim depending therefrom, is respectfully requested.

Applicants have canceled Claim 18, 26 and 36, obviating the rejection thereof.

Claim Rejections: 35 USC §103

The Action rejects Claims 17, 19, 25, 27, 35 and 37 as being unpatentable over Deshpande et al, in light of "selecting suitable thickness/height for gate material being well known in the art."

Applicants have cancelled Claims 19, 27 and 37 for reasons not having to do with patentability, obviating the rejection thereof. Claim 17 is dependent on Claim 12; Claim 25 is dependent on Claim 22; Claim 35 is dependent on Claim 31. As noted above, Deshpande fails to disclose each and every element of independent Claims 12, 22 and 31, and Deshpande teaches away from that required by independent Claims 22 and 31. Even if the prior art is assumed to have taught selection of a suitable thickness or height for the gate material, such teaching does not cure the deficiency of Deshpande with respect to claims 12, 22 and 31, as set forth above. Claims 17, 25 and 35 should be allowable for at least the same reasons as their respective base claims, as stated above. Reconsideration and withdrawal of the rejection of these claims is respectfully requested.

In view of the foregoing amendments and remarks, Applicant submits that this application is in condition for allowance. Early notification to that effect is respectfully requested.

The Assistant Commissioner for Patents is hereby authorized to charge any additional fees or credit any excess payment that may be associated with this communication to deposit account **04-1679.**

Respectfully submitted,

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